

RUSALCA 2004 and 2009: Epibenthic Fish Distribution in the Chukchi Sea

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Objectives

- Document the distribution of fish species
- Determine juvenile demersal fish assemblages (species composition)
- Compare 2009 to baseline that we established in 2004
- Determine temporal distribution of juvenile demersal fish from trace elements in otoliths

Fish collection: trawl on seafloor

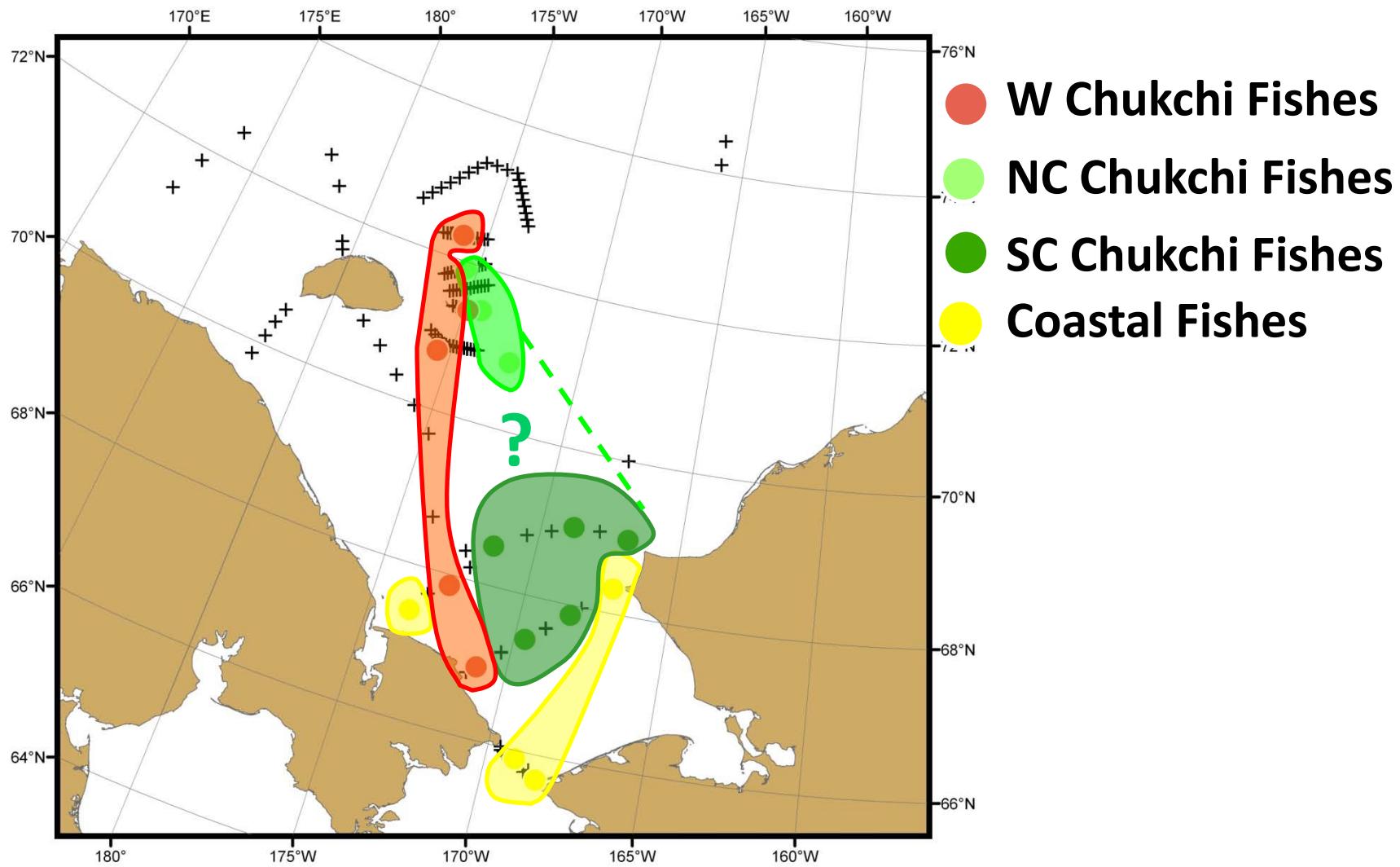
Gear varied over time



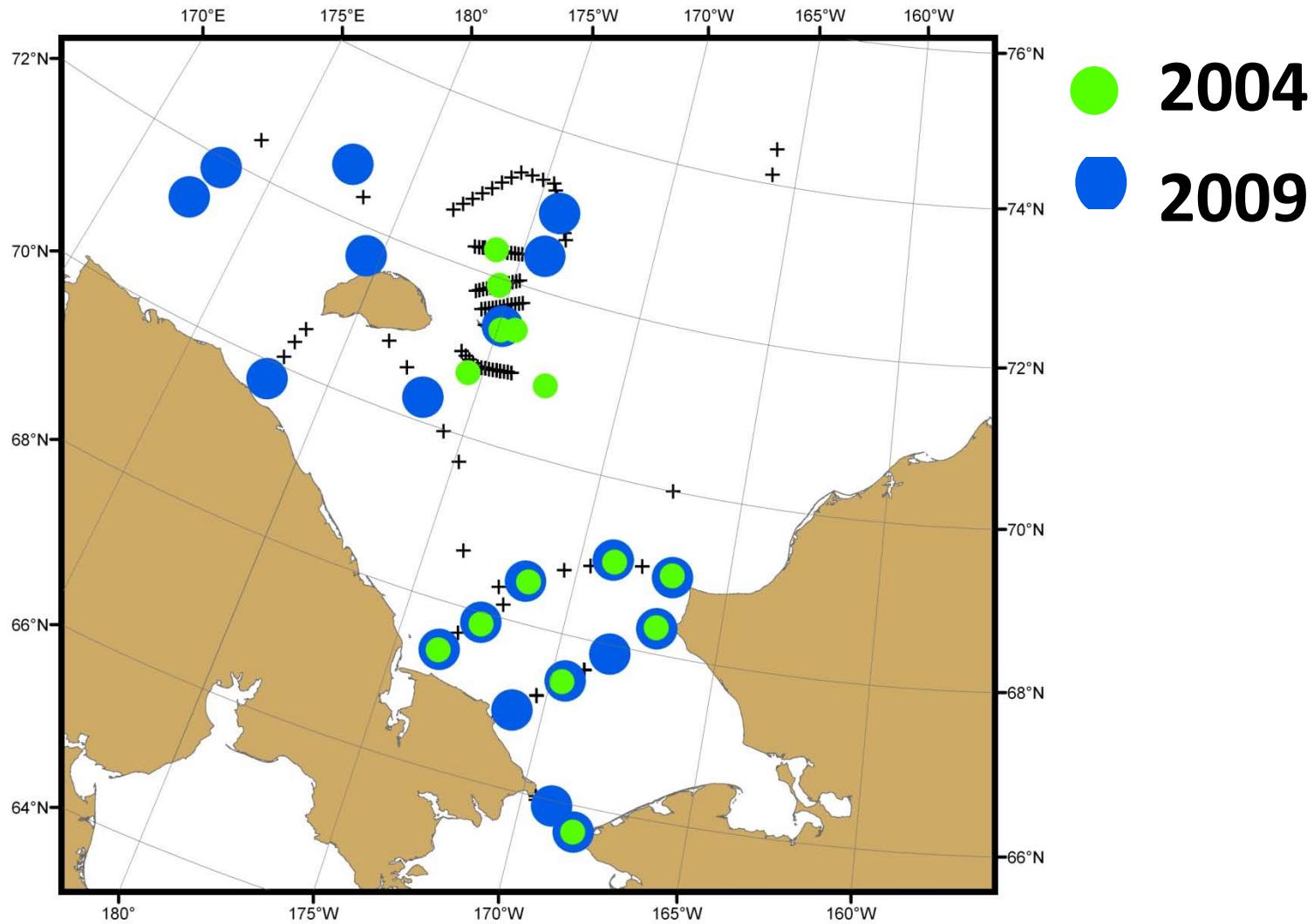
- 2004 & 2009 – Beam Trawl
3 m headrope, 4 mm liner
- 2004 – Otter Trawl
7 m headrope, 38 mm codend
- 2009 – Otter Trawl
9 m headrope, 19 mm liner

1973 – Otter Trawl 5 m headrope, 6 mm end

Fish communities based on Presence/Absence in beam trawl hauls - 2004

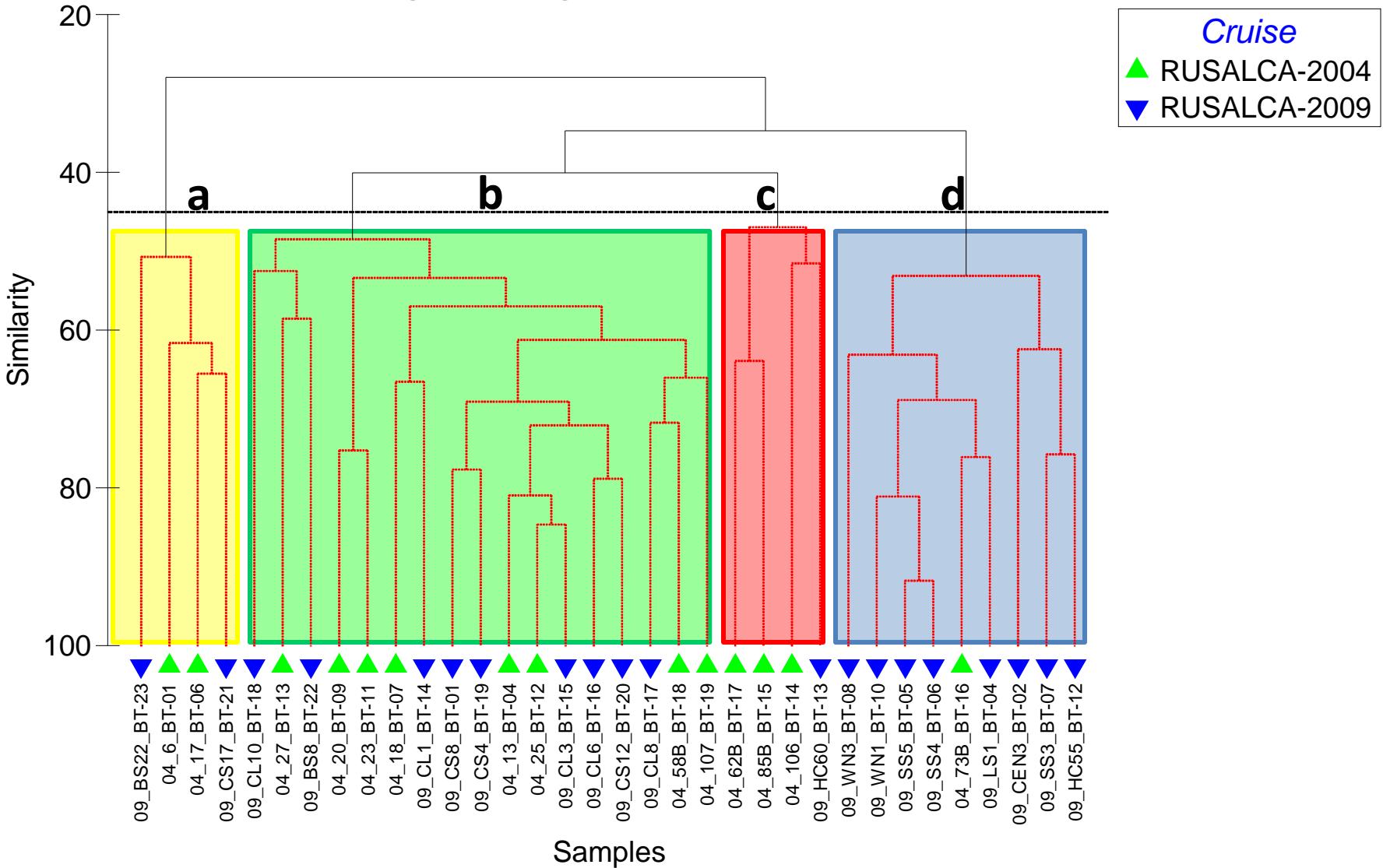


2004 & 2009 Beam Trawl sites (CPUE area)



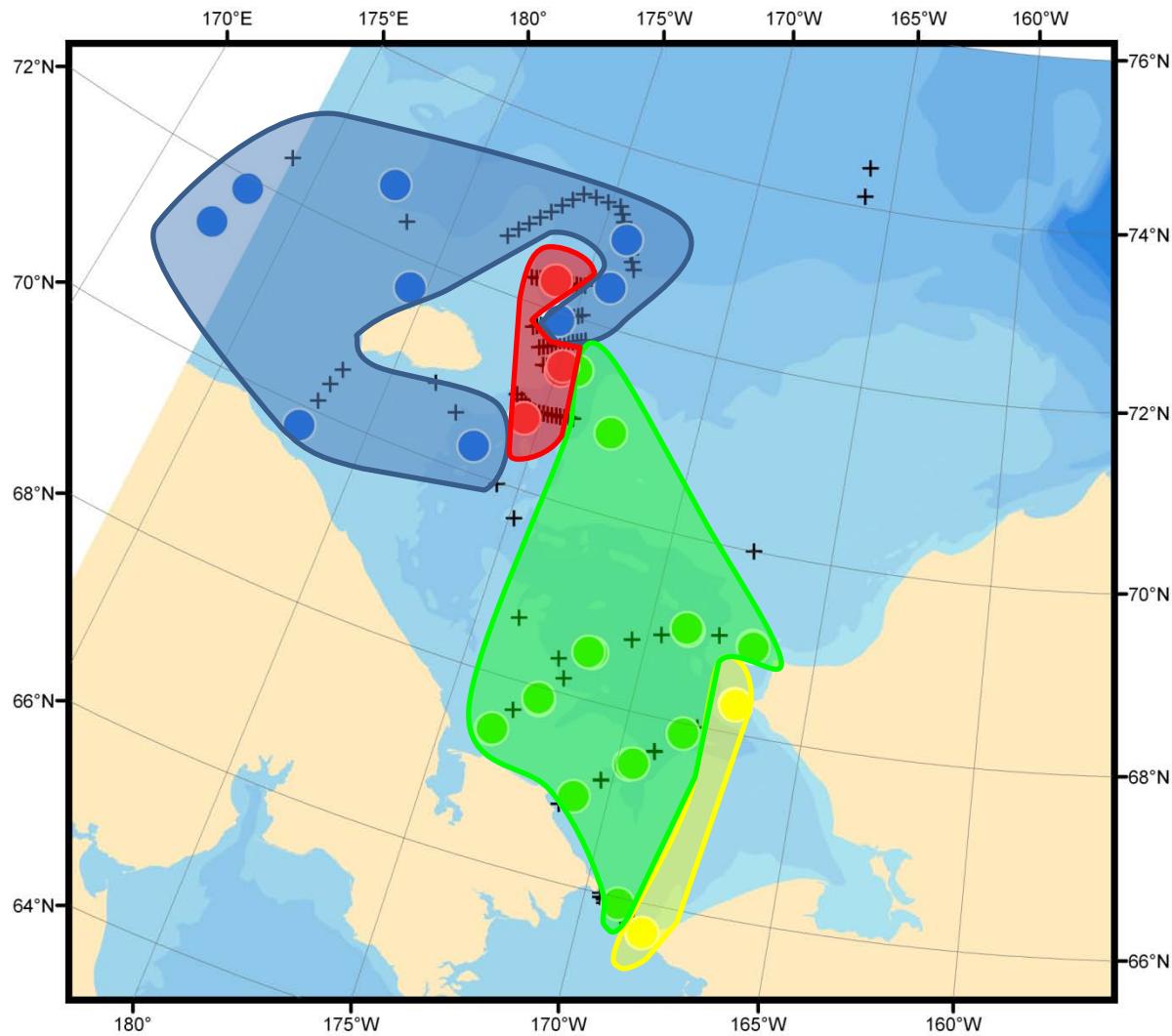
Fish communities RUSALCA 2004 & 2009

CPUE (area) Beam Trawl hauls



Fish communities RUSALCA 2004 & 2009

CPUE (area) Beam Trawl hauls



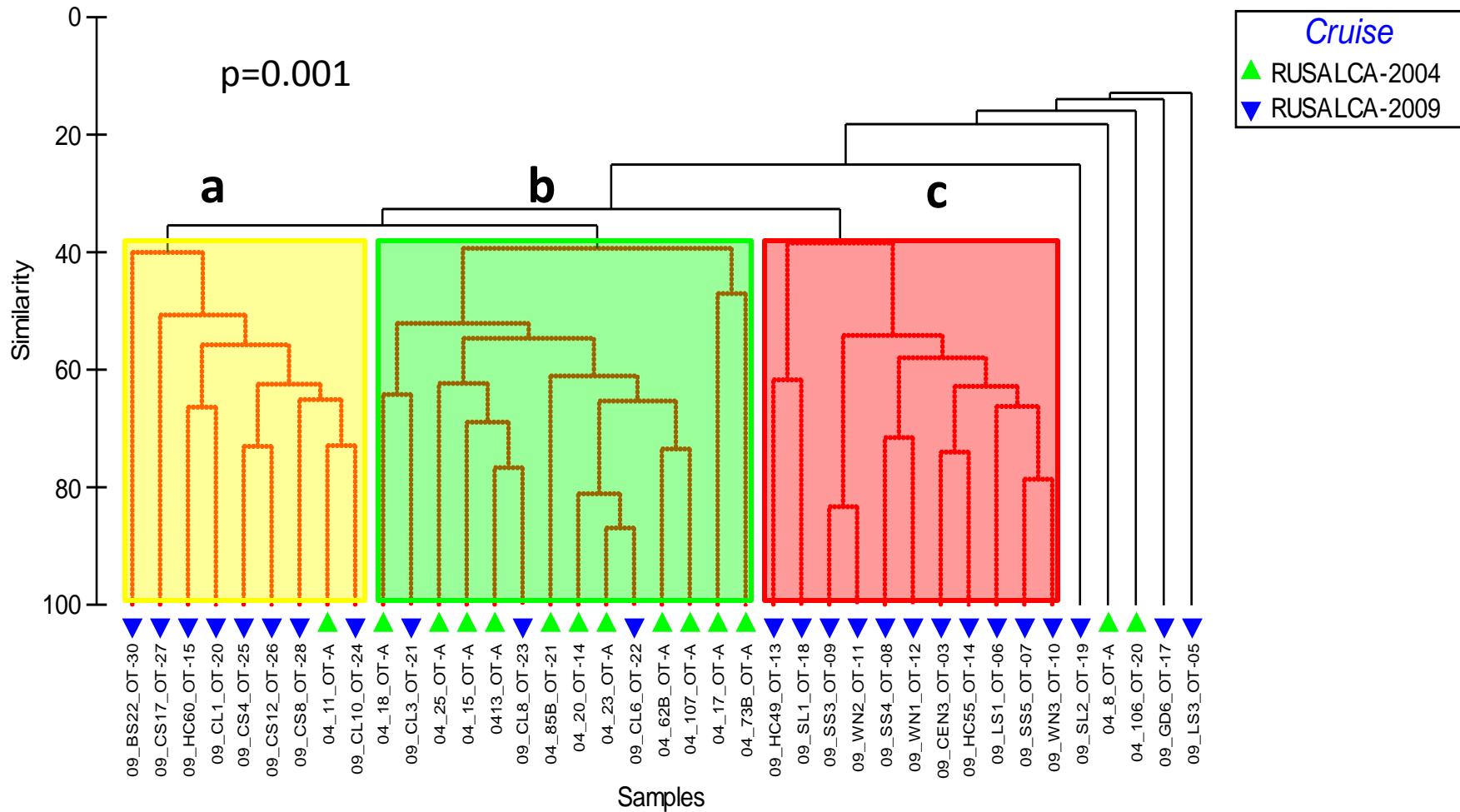
Fish communities RUSALCA 2004 & 2009

species similarity percentages Beam Trawl

Group a		Group b	
Average similarity: 56.74		Average similarity: 57.12	
Species	Cum.%	Species	Cum.%
<i>Myoxocephalus scorpius</i>	18.79	<i>Gymnophathodon tricuspidatus</i>	21.13
<i>Lumpenus fabricii</i>	35.02	<i>Myoxocephalus scorpius</i>	37.92
<i>Gymnophathodon tricuspidatus</i>	47.21	<i>Hippoglossoides robustus</i>	53.55
<i>Stichaeus punctatus</i>	59.06	<i>Anisarchus medius</i>	65.48
<i>Eleginops gracilis</i>	70.25	<i>Lumpenus fabricii</i>	76.38
<i>Gymnelus</i> spp.	74.99	<i>Boreogadus saida</i>	85.72
<i>Nautichthys pribilovius</i>	79.31		
<i>Triglops pingelii</i>	82.87		
Group c		Group d	
Average similarity: 50.47		Average similarity: 61.47	
Species	Cum.%	Species	Cum.%
		<i>Boreogadus saida</i>	28.02
		<i>Lycodes polaris</i>	53.84
<i>Gymnophathodon tricuspidatus</i>	43.57	<i>Anisarchus medius</i>	77.07
<i>Boreogadus saida</i>	86.24	<i>Icelus spatula</i>	88.68

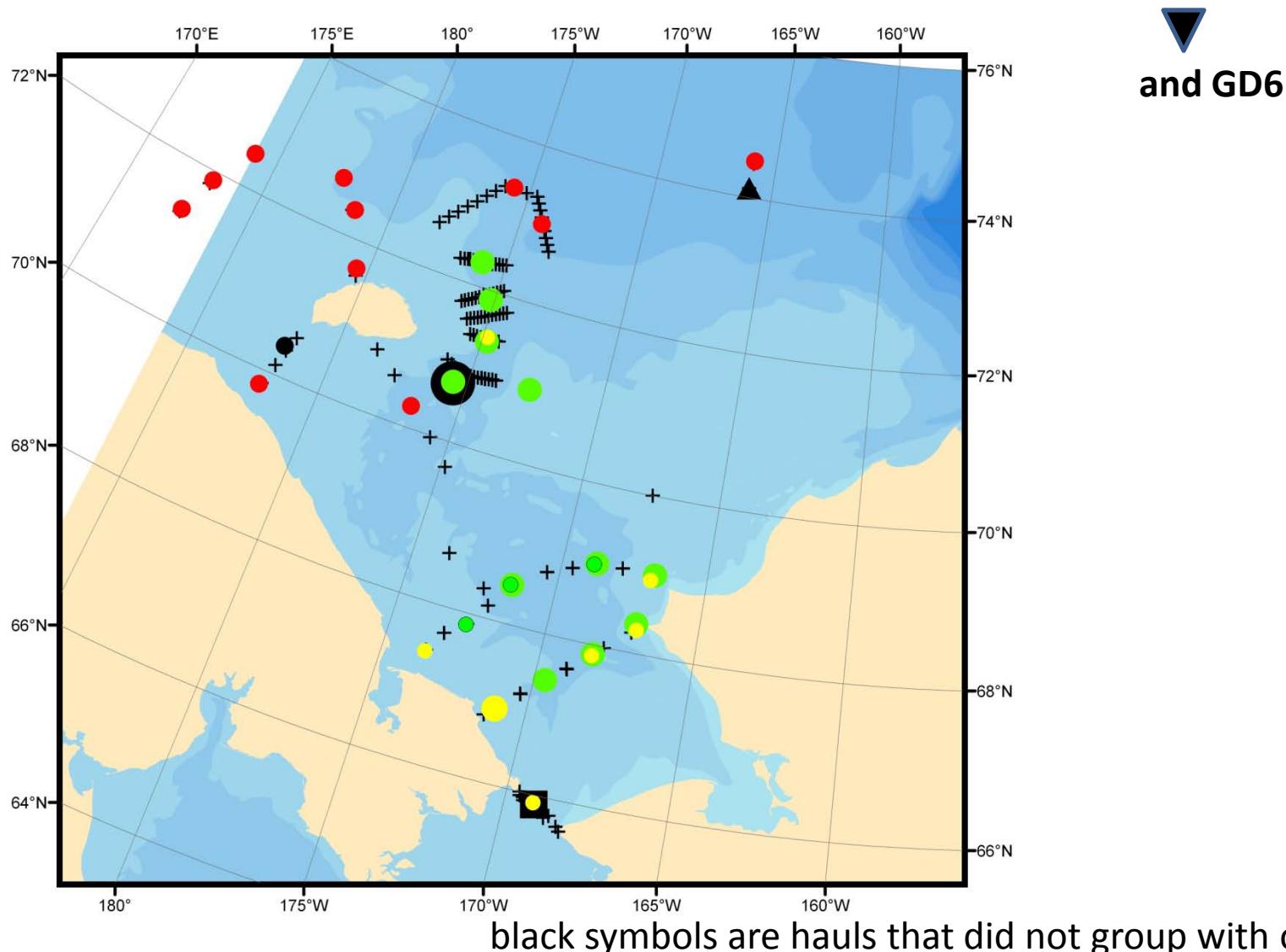
Fish communities RUSALCA 2004 & 2009

CPUE (distance) Otter Trawl hauls



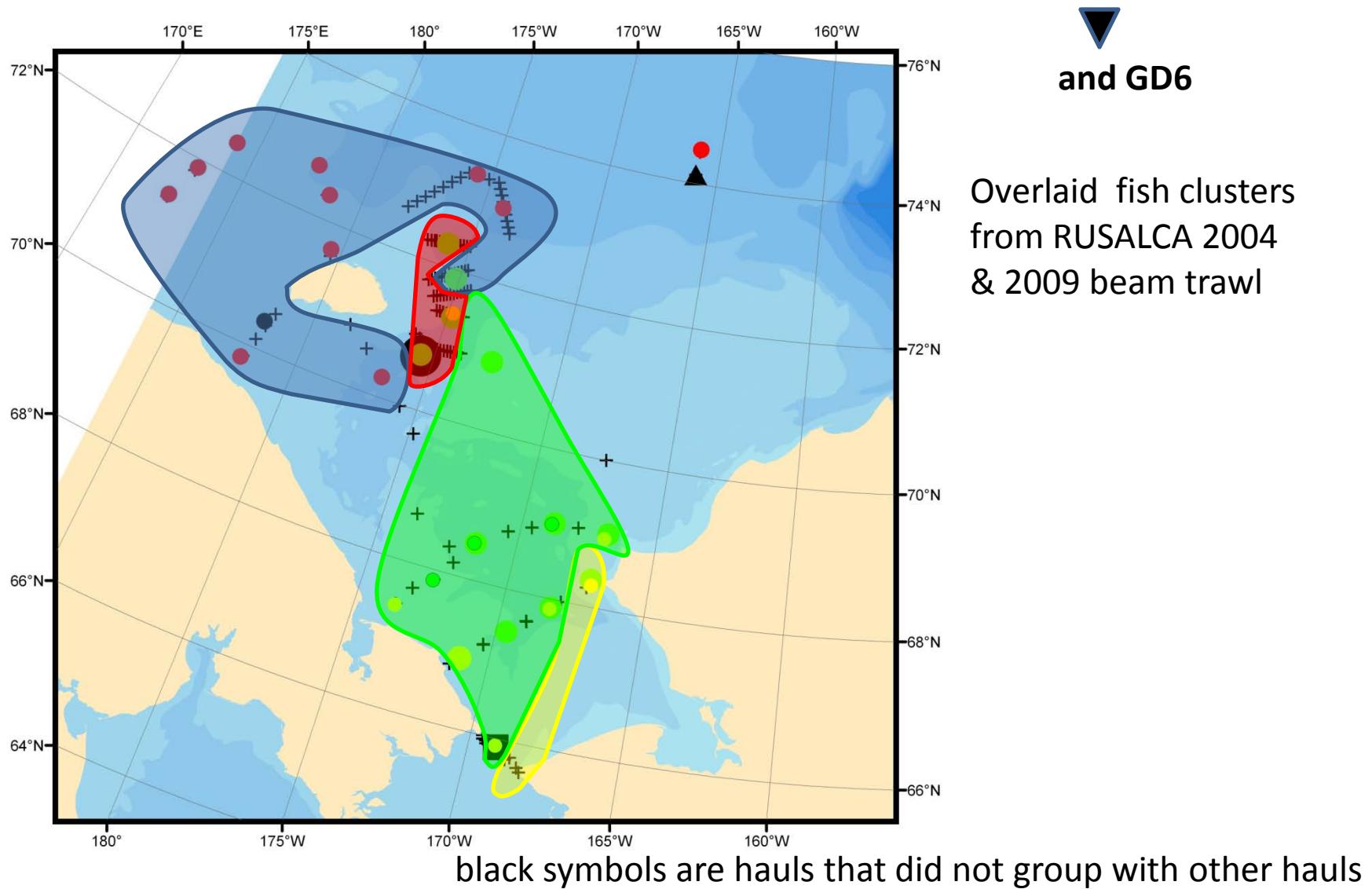
Fish communities RUSALCA 2004 & 2009

CPUE (distance) Otter Trawl hauls



Fish communities RUSALCA 2004 & 2009

CPUE (distance) Otter Trawl hauls

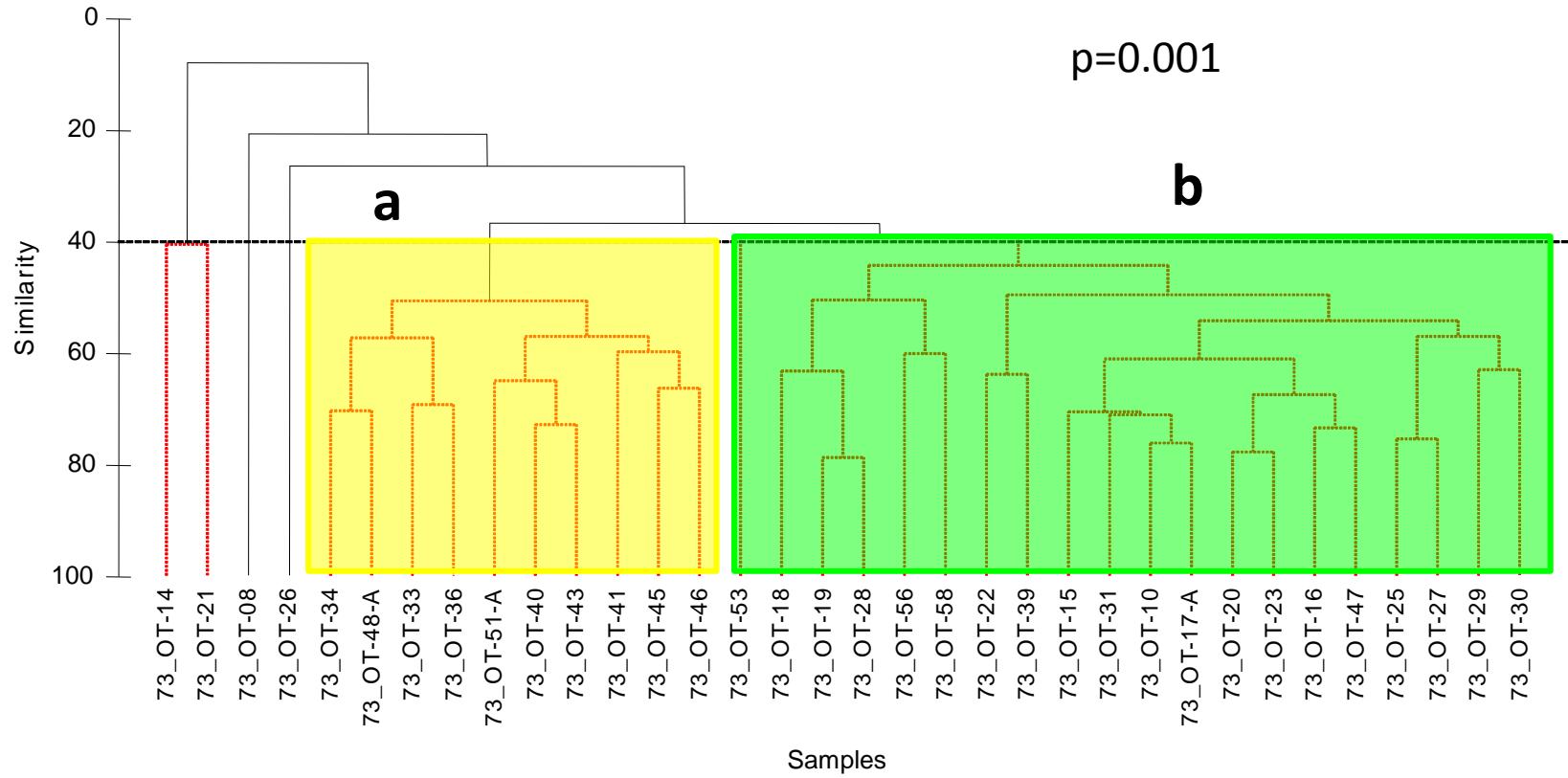


Fish communities RUSALCA 2004 & 2009

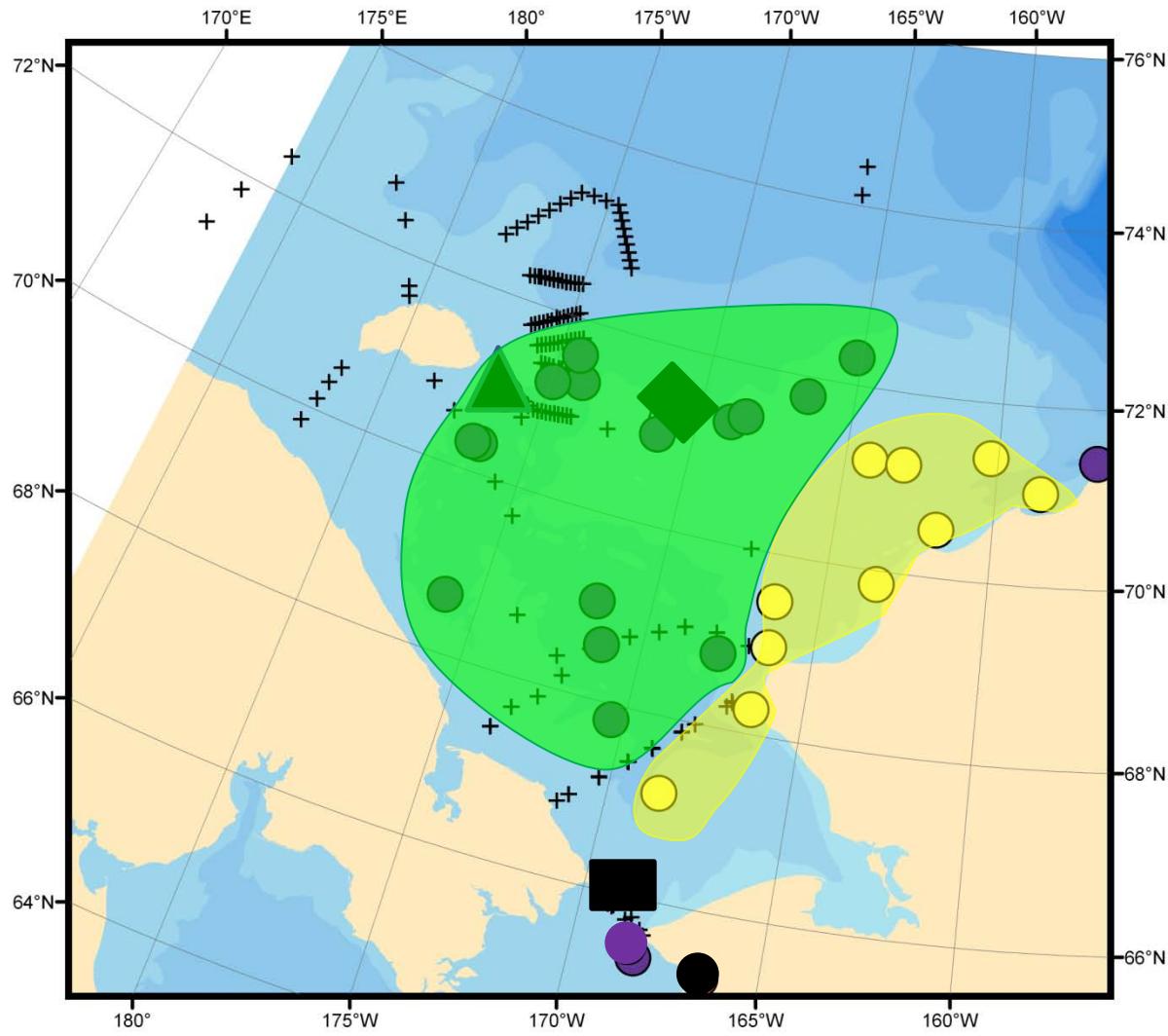
species similarity percentages Otter Trawl

Group a		Group b	
Average similarity: 54.11		Average similarity: 53.04	
Species	Cum.%	Species	Cum.%
<i>Myoxocephalus scorpius</i>	20.78	<i>Boreogadus saida</i>	39.37
<i>Boreogadus saida</i>	39.06	<i>Hippoglossoides robustus</i>	66.91
<i>Gymnacanthus tricuspidis</i>	53.12	<i>Gymnacanthus tricuspidis</i>	87.56
<i>Lumpenus fabricii</i>	62.73		
<i>Hippoglossoides robustus</i>	71.20	Group c	
<i>Triglops pingelii</i>	78.39	Average similarity: 52.83	
<i>Liparis spp.</i>	84.98		
		Species	Cum.%
		<i>Boreogadus saida</i>	48.39
		<i>Liparis spp.</i>	64.10
		<i>Icelus spatula</i>	75.51
		<i>Lycodes polaris</i>	84.39

Fish communities *Alpha Helix* 1973 catch (count) Otter Trawl hauls

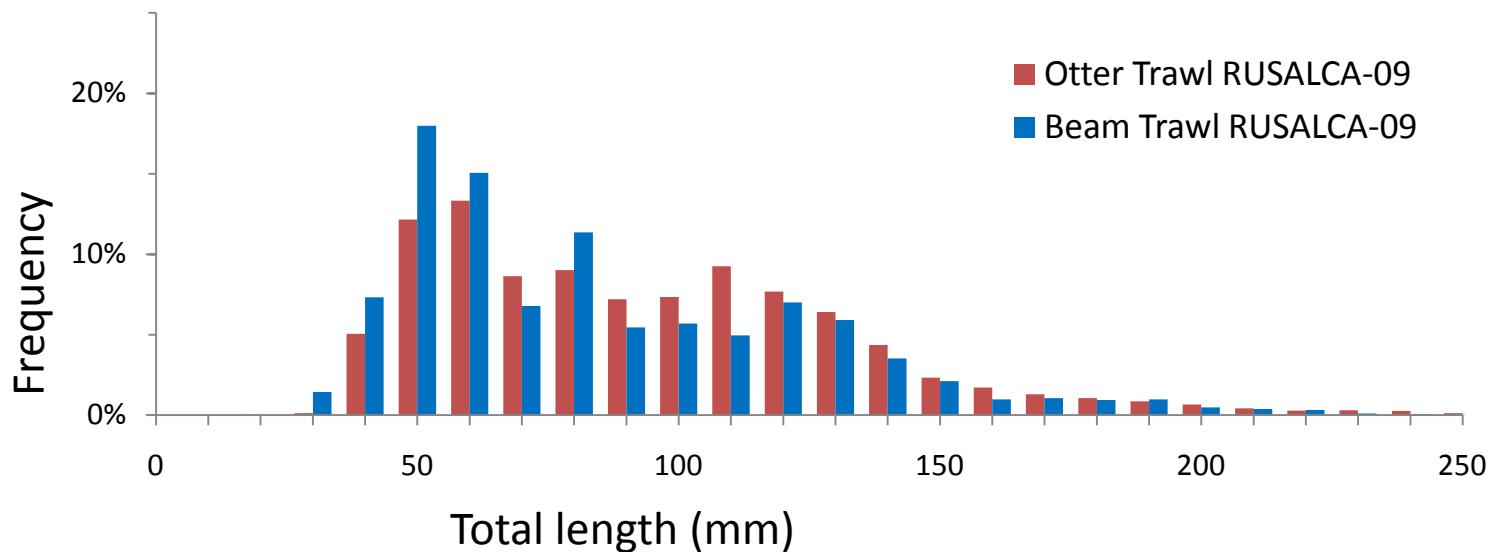
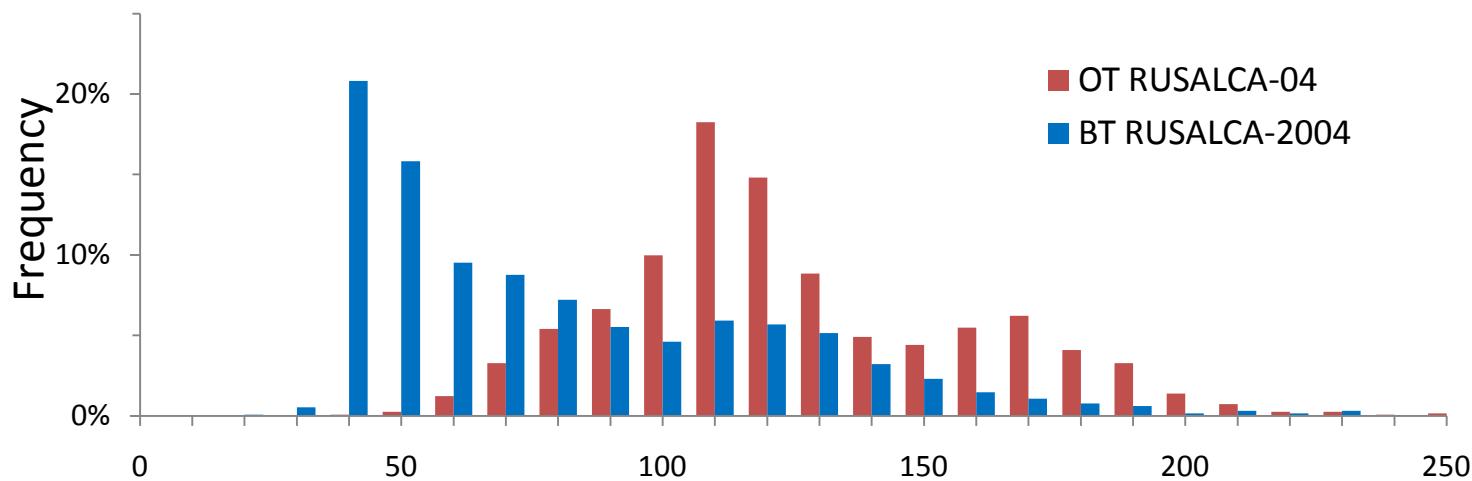


Fish communities *Alpha Helix* 1973 catch (count) Otter Trawl hauls



black symbols are hauls that did not group with other hauls

RUSALCA Lengths of all fishes



Fish species diversity

	2004 BT 3m/4mm	2009 BT 3m/4mm	2004 OT 7m/38 mm	2009 OT 9m/19mm	1973 OT 5m/6mm
S = total # species	27	33	18	39	35
N = total # individuals	1,310	10,325	1,857	11,578	5,123
Standardized N (# fish / 1000 m distance)	7,960	63,026	1,279	10,347	
d = (S – 1)/log _e N (Marglef's species richness)	2.89	2.90	2.38	4.11	3.98
Pielou's index J' (diversity)	0.67	0.40	0.51	0.49	0.49
Shannon's diversity (H log _e)	2.22	1.41	1.47	1.79	1.76
Simpson's evenness index (λ')	0.18	0.41	0.28	0.22	0.31

Trace Elements – Water and Otoliths

sculpin otolith

Otolith preparation:

- Dissection from fish
- Thin section cut
- Polish
- ICPMS core-edge transect
- Measure Ca, Sr, Mg, Ba
- Data analysis

Edge



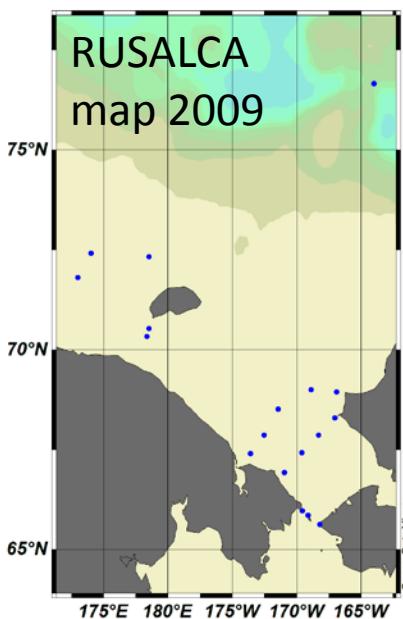
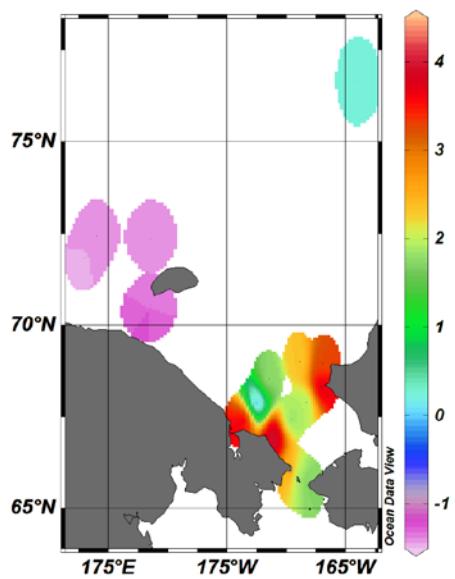
ICPMS



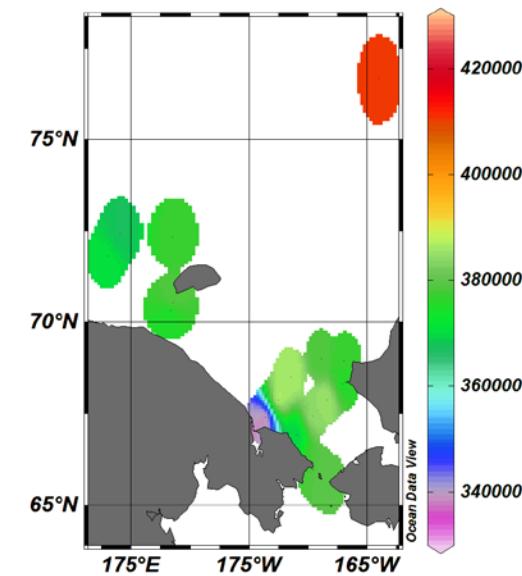
- Core= egg and larval stage
- Edge= most recent growth
- Transect = complete story

RUSALCA 2009 Bottom Water Trace Elements n=18 stations

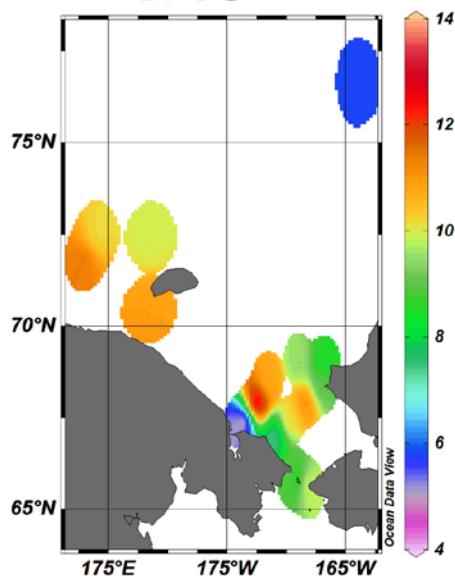
T90 [C] @ Pres=first



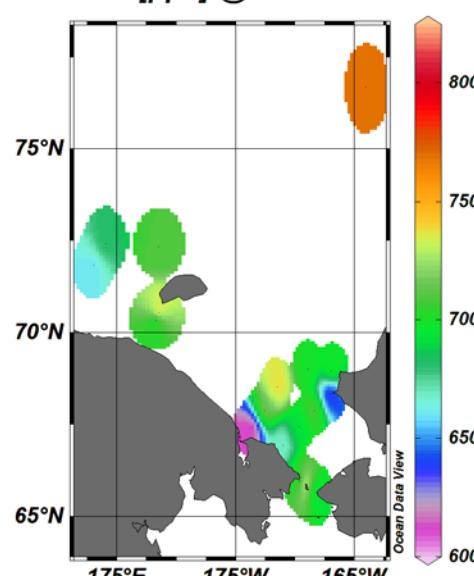
Ca* [ppb] @ Pres=first



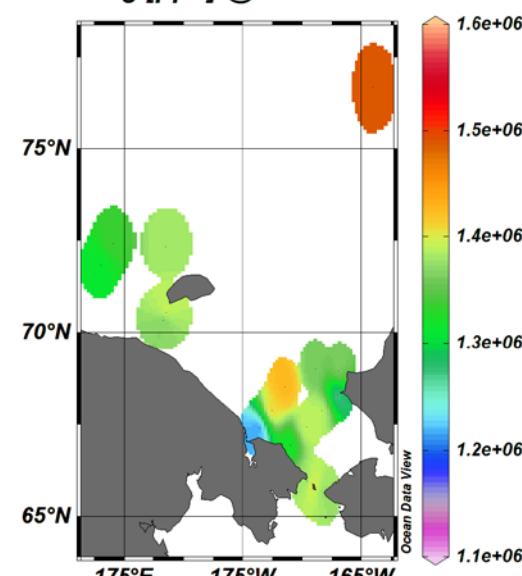
Ba [ppb] @ Pres=first



Sr [ppb] @ Pres=first



Mg [ppb] @ Pres=first



Otoliths are a time record that tell the fish's life story

Ambient seawater

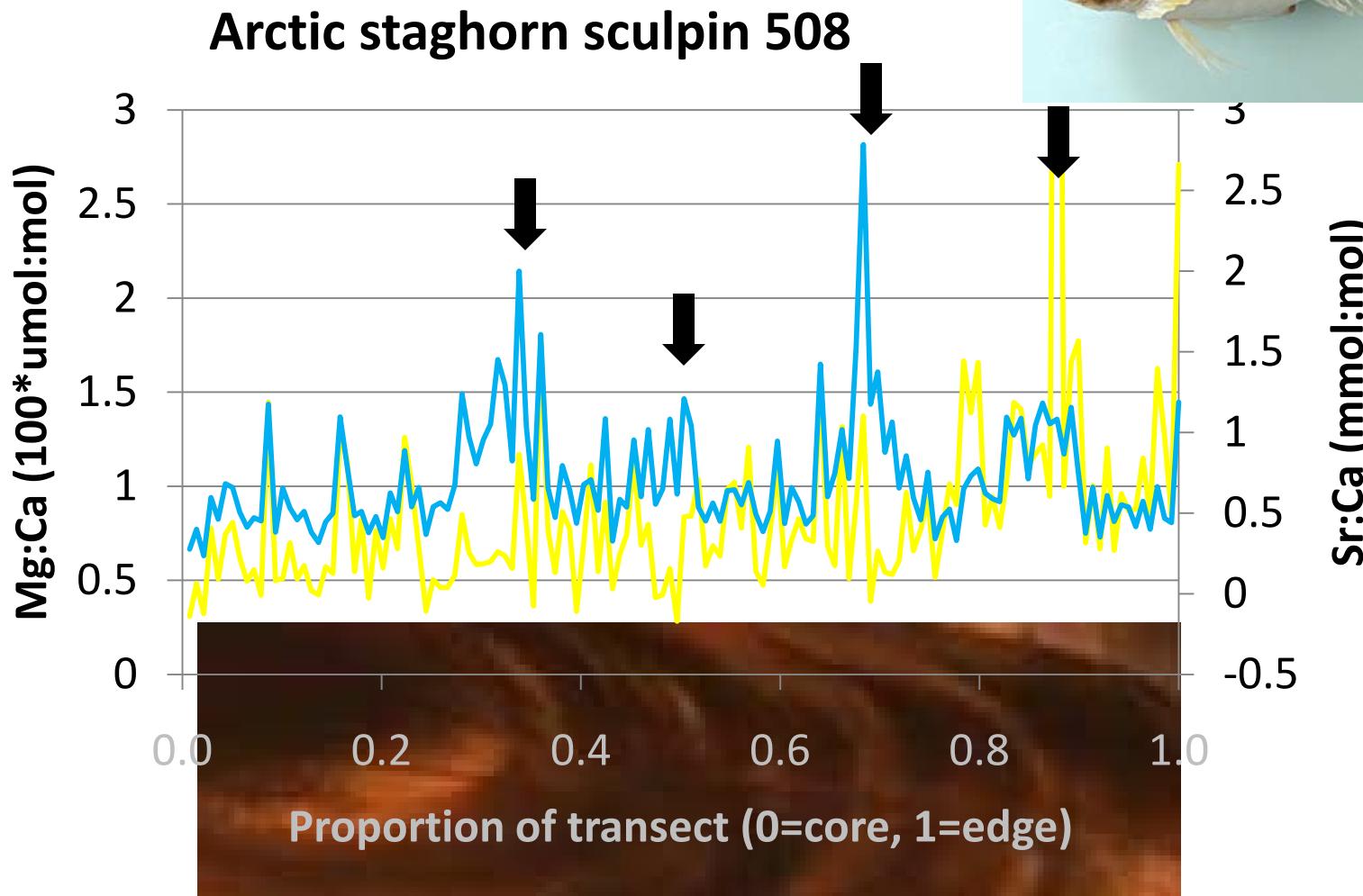
Source of recruitment
Larval → adult settlement
Spawning locations
Geographic distribution
Coastal-offshore migration
Stock structure
Climate impact

Physiology

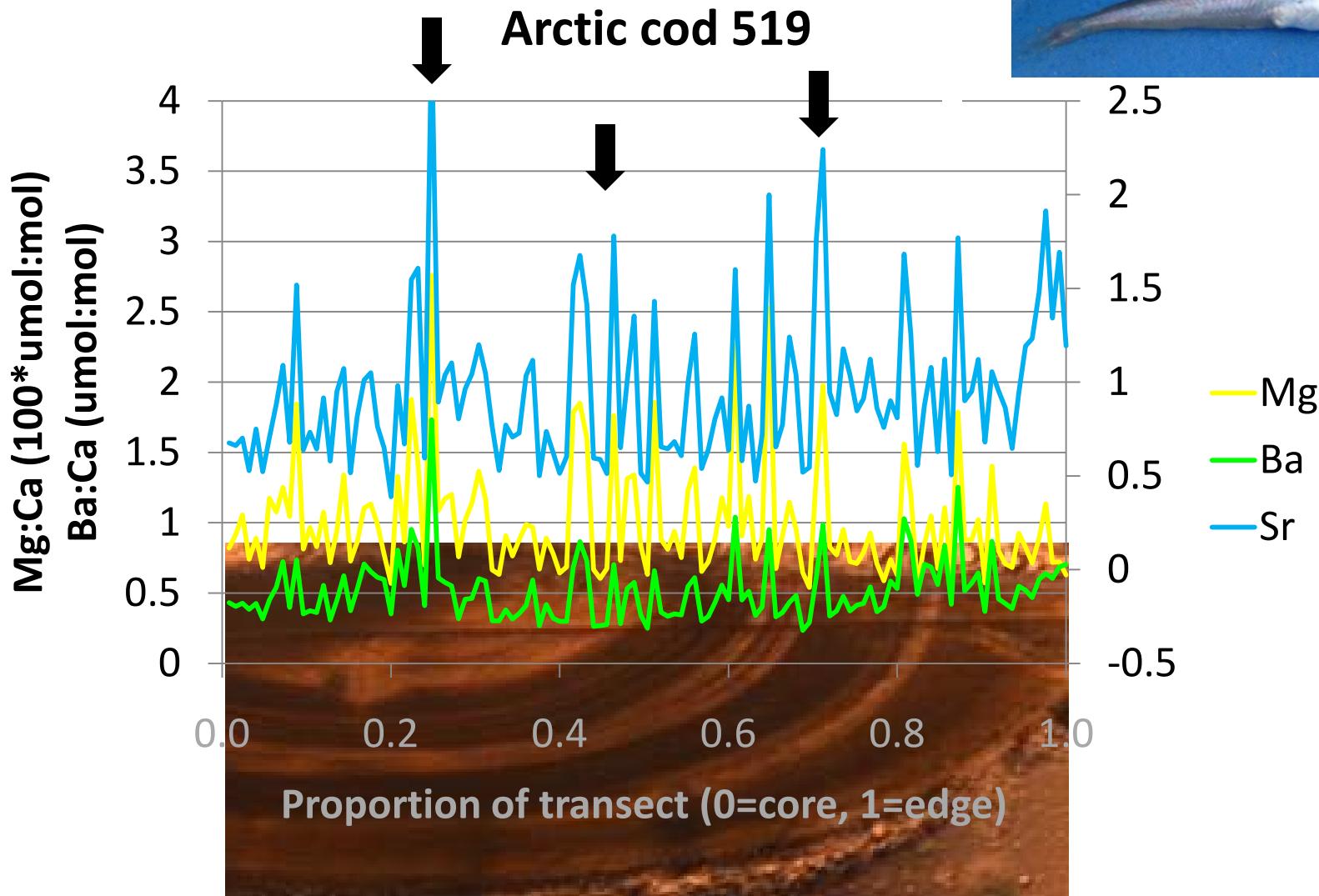
Ontogenetic shifts
Larval → adult settlement
Gonad development
Spawning events
Climate impact



Nearshore South



Offshore North



Conclusions so far...

- Adding more sites provides a more clear picture of fish communities
- Most abundant species – Arctic cod
- Length of fishes is small even with large mesh net
- Small mesh net yields greater diversity
- Diversity relatively similar over time
- Need to continue fishing Beam Trawl

More to come

- Investigating physical factors associated with fish distribution
- Compare 2004/2009 repeated stations
- Biomass comparisons:
 - 2004: Calculate biomass based on length/weight relationship established for each fish species
 - 2009: Measured
- Expand analysis to NE Chukchi with our other projects



Thank you, Спасибо!